IN THE CLAIMS

Amend the claims as follows.

1-30. (Cancelled)

31. (Previously Presented) A method of compensating for frequency offset in a received signal, comprising:

constructing a reference signal comprising a training sequence of the received signal and one or more basis functions;

minimizing a cost function associated with the reference signal, wherein the cost function comprises the training sequence, the one or more basis functions, and the received signal; and

acquiring a desired frequency-shifted signal when the cost function indicates a predetermined degree of correlation between the reference signal and the received signal.

32. (Previously Presented) The method according to Claim 31, wherein a minimum cost function indicates a maximum degree of correlation between the reference signal and the received signal.

33. (Previously Presented) The method according to Claim 31, wherein the cost function further comprises a constraint to obtain non-trivial solutions.

34. (Previously Presented) The method according to Claim 33, wherein the constraint requires non-zero signal power.

35. (Currently Amended) The method according to Claim 31, wherein the cost function is J given by:

$J = ||Xw - CFv||^2 + \lambda(w^H X^H Xw-1)$, wherein X is a matrix of received signal samples, wherein w is a vector of beamforming weights configured to minimize J,

wherein C is a diagonal matrix having elements of the training sequence on its diagonal, wherein F is a matrix having columns defining respective basis functions, wherein v is a vector of weights configured to minimize J, wherein superscript index H indicates a complex conjugate transpose, and wherein λ is a Lagrange multiplier for a term to constrain beamformer output power to be non-zero.

36. (Previously Presented) The method according to Claim 35, further comprising:

determining the vectors w and v at intervals from estimates of a correlation matrix determined from multiple data vectors and from inverses of such estimates recursively updated to reflect successive new data vectors which are rows of the matrix X.

37. (Currently Amended) The method according to Claim 36, wherein the inverse correlation matrices are recursively updated by:

forming a vector u(n) having a first element $u_1(n)$ equal to $\sqrt{U_{1,1}(n)}$ and other elements $u_p(n)$ (p= 2 to M) which are respective ratios $U_{p,1}(n)/u_1(n)$, wherein $U_{p,1}(n)$ is a pth element of a first column of a matrix U(n), wherein the matrix $U(n) = u(n)u^H(n) = x(n)x^H(n)-x(n-K+1)x^H(n-K+1)$, wherein x(n) is a most recent data vector, wherein $x(n-K+1)$ is a least recent data vector involved in updating, and wherein $x(n)x^H(n)$ and $x(n-K+1)x^H(n-K+1)$ are correlation matrices;

premultiplying a previous inverse correlation matrix P(n -1) by vector $u^H(n)$ and postmultiplied by the vector u(n) to form a product;

adding the product to a forget factor to form a sum;

postmultiplying the previous inverse correlation matrix P(n -1) by the vector u(n) to form a second product;

dividing the second product by the sum to form a quotient; and

subtracting the quotient from the previous inverse correlation matrix P(n -1) to provide a difference.

38. (Previously Presented) The method according to Claim 31, wherein the received signal is acquired by a single antenna element.

39. (Previously Presented) The method according to Claim 38, wherein the cost function is J given by:

$J = \|x - CFv\|^2$, wherein x is a vector of received signal samples, wherein C is a diagonal matrix having elements of the training sequence on its diagonal, wherein F is a matrix having columns defining respective basis functions, and wherein v is a vector of weights configured to minimize J.

40. (Previously Presented) The method according to Claim 38, wherein the cost function is J given by:

$J = \|\alpha x - Gv\|^2 + \lambda(\alpha^* x^H x\alpha - 1)$, wherein α is a scaling factor, wherein x is a vector of received signal samples, wherein C is a diagonal matrix having elements of the training sequence on its diagonal, wherein F is a matrix having columns defining respective basis functions, wherein G is a matrix equal to CF, wherein v is a vector of weights configured to minimize J, wherein superscript index H indicates a complex conjugate transpose, and wherein λ is a Lagrange multiplier for a term to constrain beamformer output power to be non-zero.

41. (Currently Amended) An apparatus ~~Apparatus~~ configured to compensate for frequency offset in a received signal, wherein the apparatus comprises:

means for constructing a reference signal comprising one or more basis functions and a training sequence, wherein the means for constructing the reference signal is configured to minimize a cost function comprising the one or more basis functions, the training sequence, and the received signal; and

means for acquiring a desired frequency-shifted signal when the cost function indicates a predetermined degree of correlation between the reference signal and the received signal.

42. (Cancelled)

43. (Currently Amended) The apparatus ~~Apparatus~~ according to Claim 41, wherein the means for acquiring comprises multiple antenna elements.

44. (Currently Amended) The apparatus ~~Apparatus~~ according to Claim 43, wherein the cost function further comprises a constraint to obtain a non-trivial solution, and wherein the constraint requires non-zero signal power.

45. (Currently Amended) The apparatus ~~Apparatus~~ according to Claim 41, wherein the cost function is J given by:

$J = \|Xw - CFv\|^2 + \lambda(w^H X^H Xw - 1)$, wherein X is a matrix of received signal samples, wherein w is a vector of beamforming weights configured to minimize J, wherein C is a diagonal matrix having elements of the training sequence on its diagonal, wherein F is a matrix having columns defining respective basis functions, wherein v is a vector of weights configured to minimize J, wherein superscript index H indicates a complex conjugate transpose, and wherein λ is a Lagrange multiplier for a term to constrain beamformer output power to be non-zero.

46. (Currently Amended) The apparatus ~~Apparatus~~ according to Claim 45, further comprising:

means for determining the vectors w and v at intervals from estimates of a correlation matrix determined from multiple data vectors and from inverses of such estimates recursively updated to reflect successive new data vectors which are rows of the matrix X.

47. (Currently Amended) The apparatus ~~Apparatus~~ according to Claim 45, further comprising means for recursively updating inverse correlation matrices by:

forming a vector u(n) having a first element $u_1(n)$ equal to $\sqrt{U_{1,1}(n)}$ and other elements $u_p(n)$ (p= 2 to M) which are respective ratios $U_{p,1}(n)/u_1(n)$, wherein $U_{p,1}(n)$ is a

pth element of a first column of a matrix U(n), wherein the matrix $U(n) = u(n)u^H(n) = x(n)x^H(n)-x(n - K + 1)x^H(n - K + 1)$, wherein x(n) is a most recent data vector, wherein $x(n - K + 1)$ is a least recent data vector involved in updating, and wherein $x(n)x^H(n)$ and $x(n - K + 1)x^H (n - K + 1)$ are correlation matrices;

premultiplying a previous inverse correlation matrix P(n -1) by vector u^H (n) and postmultiplied by the vector u(n) to form a product;

adding the product to a forget factor to form a sum;

postmultiplying the previous inverse correlation matrix P(n -1) by the vector u(n) to form a second product;

dividing the second product by the sum to form a quotient; and

subtracting the quotient from the previous inverse correlation matrix P(n -1) to provide a difference.

48. (Currently Amended) The apparatus ~~Apparatus~~ according to Claim 41, wherein the means for acquiring comprises a single antenna element, and wherein the single antenna is configured to product a single output signal for any given sample time.

49. (Currently Amended) The apparatus ~~Apparatus~~ according to Claim 41, wherein the cost function is J given by:

$J = ||x - CFv||^2$, wherein x is a vector of received signal samples, wherein C is a diagonal matrix having elements of the training sequence on its diagonal, wherein F is a matrix having columns defining respective basis functions, and wherein v is a vector of weights configured to minimize J.

50. (Currently Amended) The apparatus ~~Apparatus~~ according to Claim 41, wherein the cost function is J given by:

$J =||\alpha x - Gv||^2 + \lambda(\alpha^* x^H x\alpha -1)$, wherein α is a scaling factor, wherein x is a vector of received signal samples, wherein C is a diagonal matrix having elements of the training sequence on its diagonal, wherein F is a matrix having columns defining respective basis functions, wherein G is a matrix equal to CF, wherein v is a vector of

weights configured to minimize J, wherein superscript index H indicates a complex conjugate transpose, and wherein λ is a Lagrange multiplier for a term to constrain beamformer output power to be non-zero.

51. (Currently Amended) A computer-readable medium having stored thereon[[,]] computer-executable instructions that, in response to execution ~~if executed~~ by a system, cause the system to perform operations ~~a method~~ comprising:

constructing a reference signal comprising an original training sequence and a plurality of sinusoidal basis functions;

minimizing a cost function associated with the reference signal, wherein the cost function comprises the original training sequence, the plurality of sinusoidal basis functions, and a received signal; and

acquiring a desired frequency-shifted signal when the cost function indicates a predetermined degree of correlation between the reference signal and the received signal.

52. (Currently Amended) The computer-readable medium according to Claim 51, wherein the operations ~~method~~ further comprise ~~comprises~~:

constructing a comparison training sequence that is an adaptively formed combination of the plurality of sinusoidal basis functions and the original training sequence.

53. (Previously Presented) The computer-readable medium according to Claim 51, wherein the cost function further comprises a constraint to obtain non-trivial solutions, and wherein the constraint requires non-zero signal power.

54. (Cancelled)

55. (Currently Amended) The computer-readable medium according to Claim 51, wherein the cost function is J given by:

$J = ||Xw - CFv||^2 + \lambda(w^H X^H Xw-1)$, wherein X is a matrix of received signal samples, wherein w is a vector of beamforming weights configured to minimize J, wherein C is a diagonal matrix having elements of the training sequence on its diagonal, wherein F is a matrix having columns defining respective basis functions, wherein v is a vector of weights configured to minimize J, wherein superscript index H indicates a complex conjugate transpose, and wherein λ is a Lagrange multiplier for a term to constrain beamformer output power to be non-zero.

56. (Currently Amended) The computer-readable medium according to Claim 55, wherein the operations ~~method~~ further comprise ~~comprises~~:

determining the vectors w and v at intervals from estimates of a correlation matrix determined from multiple data vectors and from inverses of such estimates recursively updated to reflect successive new data vectors which are rows of the matrix X.

57. (Currently Amended) The computer-readable medium according to Claim 55, wherein the operations ~~method~~ further comprise ~~comprises~~ recursively updating inverse correlation matrices by:

forming a vector u(n) having a first element $u_1(n)$ equal to $\sqrt{U_{1,1}(n)}$ and other elements $u_p(n)$ (p= 2 to M) which are respective ratios $U_{p,1}(n)/u_1(n)$, wherein $U_{p,1}(n)$ is a pth element of a first column of a matrix U(n), wherein the matrix $U(n) = u(n)u^H(n) = x(n)x^H(n)-x(n-K+1)x^H(n-K+1)$, wherein x(n) is a most recent data vector, wherein $x(n-K+1)$ is a least recent data vector involved in updating, and wherein $x(n)x^H(n)$ and $x(n-K+1)x^H(n-K+1)$ are correlation matrices;

premultiplying a previous inverse correlation matrix P(n -1) by vector $u^H(n)$ and postmultiplied by the vector u(n) to form a product;

adding the product to a forget factor to form a sum;

postmultiplying the previous inverse correlation matrix P(n -1) by the vector u(n) to form a second product;

dividing the second product by the sum to form a quotient; and

subtracting the quotient from the previous inverse correlation matrix $P(n-1)$ to provide a difference.

58. (Previously Presented) The computer-readable medium according to Claim 51, wherein the received signal is acquired by a receiver comprising a single antenna element.

59. (Currently Amended) The computer-readable medium according to Claim 58, wherein the cost function is J given by:

$J = \|x - CFv\|^2$, wherein x is a vector of received signal samples, wherein C is a diagonal matrix having elements of the <u>original</u> training sequence on its diagonal, wherein F is a matrix having columns defining respective basis functions, and wherein v is a vector of weights configured to minimize J.

60. (Currently Amended) The computer-readable medium according to Claim 58, wherein the cost function is J given by:

$J = \|\alpha x - Gv\|^2 + \lambda(\alpha^* x^H x\alpha - 1)$, wherein α is a scaling factor, wherein x is a vector of received signal samples, wherein C is a diagonal matrix having elements of the <u>original</u> training sequence on its diagonal, wherein F is a matrix having columns defining respective basis functions, wherein G is a matrix equal to CF, wherein v is a vector of weights configured to minimize J, wherein superscript index H indicates a complex conjugate transpose, and wherein λ is a Lagrange multiplier for a term to constrain beamformer output power to be non-zero.

61. (Previously Presented) The method according to Claim 31, wherein the one or more basis functions comprise a sinusoid.

62. (Currently Amended) The apparatus according to Claim 41, wherein the one or more basis <u>functions</u> span a subspace in which a complex sinusoid associated with the frequency offset lies.